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A Monthly Magazine Devoted to the Interests of Teachers of Geography in Elementary, Secondary, and Normal Schools

RAY HUGHES WHITBECK, Editor
Professor of Geography at the University of Wisconsin

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The JOURNAL of GEOGRAPHY

Volume XVII SEPTEMBER 1918 Number 1

THE REEF-ENCIRCLED ISLANDS OF THE PACIFIC

By W. M. DAVIS
Cambridge, Mass.

CORAL REEFS AND THE WAR

IN THIS period of turmoil a retired professor of geography, after doing the little in his power to help win the war, for example, by writing a "Handbook of Northern France" descriptive of the physiographic features of the western front, and after making his small contribution to the well-being of our soldiers abroad by compiling a guide book for "Excursions around Aix-le-Bains," the seat of our rest-camp in the French Alps, finds restful distraction in recalling the distant and quiet, reef-encircled islands of the central Pacific, 35 of which he visited on a Shaler-Memorial journey the year the world-war began. Yet even on those isolated mountains, rising above the warm mid-ocean surface from the deep and cold ocean floor, and furnishing remote outposts for colonization from the continents, the effects of the war were felt before it was two months in progress.

On September 22, 1914, two days before my arrival at the Society Islands, two German cruisers, Scharnhorst and Gneisenau, on their way from Kiau-Chau on the coast of China where they had been driven away by the Japanese, to join the German fleet on the coast of Chili, had bombarded Papeete, the capital of Tahiti and seat of the French governor of the *"Etablissements francaise de l'Oceanie"*, creating great alarm as may be imagined; the cruisers were afterwards sunk with the rest of the fleet by the British off the Falkland Islands. When I landed at Papeete, a number of German merchants and others, who had been interned by the French, were occupied, evidently much against their will, in cleaning up the remains of two business blocks laid in ruins by the bombardment. But of more wide-spread effect was the fall in the price offered for copra, the dried white "meat" of the coconut A large amount of this tropical product that had in previous years been used in Germany no longer found a market, and thus the natives on many a Pacific island for a time at least suffered a loss of income.

Volcanic Islands

The mountainous islands of the mid-Pacific are nearly all of volcanic origin. They are huge and broad-based conical heaps of lava, built up by long continued eruption from the ocean bottom. The first appearance of such an island above sea level has occasionally been recorded. The famous Graham island, an ash-cone which was built up about 200 feet above the Mediterranean surface in 1831 and which was destroyed by wave action in the same year, has a Pacific parallel in Falcon island which appeared in the Tonga group in 1885; it was visited four years later by Lister, who found it much reduced in size and wasting so rapidly under wave attack that in a few more years it would disappear, leaving a shoal on which corals might then build a reef. The disappearance of such an island may however be merely an incident in its intermittent growth: if eruptions are renewed again and repeated often enough, the island may grow in size in spite of wave attack; thus large volcanic islands are eventually formed.

Clift Volcanic Islands

Mid-ocean volcanoes must have a height of 10,000 or 15,000 feet before they reach the ocean surface, yet some of the younger volcanoes, like the broad cones of the active vents on the island of Hawaii, rise by a similar measure above sea level. Most volcanic islands are, however, of great enough age to have suffered much loss of height by erosion. Thus Reunion in the tropical Indian ocean is a volcanic mass that is not only well dissected by deep valleys, but, in the absence of protecting coral-reefs, is cut back all around its circuit in wave-sapped cliffs. It may be fairly inferred that the absence of reefs here is due to the presence, ever since the eruptive growth of the island ceased, of a beach of cobbles, gravels, and sand, supplied by the torrential streams as well as by the waves, for reef-building corals cannot establish themselves on loose detritus.

Similarly Tahiti, the largest island of the Society group in the central Pacific, is sharply dissected by many deep, steep-sided radiating valleys, and the central part of its initial cone is thus cut into many serrated ridges, the summits of which now stand forth in sharp peaks still 6000 or 7000 feet in height, yet of much less altitude than the summit of the original cone; around the borders of the island the sloping ridges broaden between the diverging, radial valleys, and show portions of the original cone, little altered: it is by the inward and upward prolongation of these preserved slopes that the summit height of the original

cone may be inferred. Moreover this fine island, altho now defended against wave attack by a barrier reef around most of its circuit, resembles Reunion in having strongly clift spur ends, showing that unlike most islands of the torrid Pacific it has, while recently free from protecting reefs, suffered marine abrasion as well as stream erosion.

In the latter respect Reunion and Tahiti resemble many reef-free volcanic islands in the cooler oceans of the world, such as Tristan da Cunha in the South Atlantic and St. Helena nearer the equator, which are rimmed by high cliffs. But unlike Reunion, the valleys of Tahiti have been well embayed: hence this island has subsided several hundred feet since its valleys and cliffs were cut: and it must have been because subsidence temporarily put a stop to beach formation, that reef-building corals, arriving from elsewhere in minute, floating, larval forms, took advantage of the opportunity and proceeded to establish themselves and build up the present barrier reef.

Maturely Dissected, Reef-encircled Volcanic Islands

Reunion and Tahiti are exceptional in having clift shores, altho in the coral seas. Most volcanic islands in those seas are old enough to be well denuded and to have lost all trace of their simple conical form; they present today a confused mass of mountainous hills separated by irregularly radiating valleys; yet in spite of their age, their spur-ends are not clift, and from this it must be inferred that even if clift for a time in their early youth, they have long been defended by coral-reef breakwaters like those that now surround them. Many islands in the Fiji group and all of the Society Islands except Tahiti, as well as Ponape in the Carolines, Vanikoro in the Santa Cruz islands and various others, are of this kind.

In the presence of encircling reefs and in the absence of cliffs, these islands differ markedly from the older extra-tropical volcanic islands, which are not only greatly worn down by the vertical attack of sub-aerial erosion, but greatly diminished in area by the horizontal attack of marine abrasion. Such islands have indeed suffered more from the energetic and unceasing work of the waves all around their circuit than they have from the slower erosion of slender streams along narrow valley bottoms, or from the still slower disintegrating work of the weather upon their exposed surface. Examples of clift and much reduced residuals of original volcanic cones are found in the small and uninhabited western members of the Hawaiian group, and in Norfolk island between New Zealand and Australia.

Dissected and Reef-encircled Islands are Embayed

It is, however, not only by erosion that the many non-clift, reef-encircled, tropical volcanic islands have been reduced in size. They have lost both height and area by subsidence; and as the later stages of the subsidence occurred after the erosion of irregularly radiating valleys was well advanced, the island shore lines have become embayed. It is, indeed, because of the systematic manner in which the embayments enter every valley in islands of this type, while the inter-valley ridges stand forward in sloping points of land, that the islands are known to have subsided.

The islands as they now survive are as a rule heavily forested, especially on the moister windward side; but some of the spurs, especially on the drier leeward slopes, are covered with a dense growth of tall reeds. Where the forests are fully exposed to the prevailing trade winds, the matted tree-tops are moulded in a smoothly curved surface of least resistance, sometimes a little fluted as if by stronger currents of wind flow. The areas of reed growth are said to have been increased by fires kindled by the natives; at a distance, the reed-covered slopes seem to be smoothly clad with grass, but on closer approach they are found to be impenetrable except where paths are kept open.

The clift islands of the temperate oceans are almost harborless, and landing upon them is a difficult matter. On the other hand, the dissected and subsided islands of the coral seas have as a rule admirable harbors in their embayments; but the harbors are not so much protected because of the configuration of the bays, many of them being diminished in size by the growth of bay-head deltas, as because of the natural breakwaters or barriers formed by off-shore coral reefs, interrupted here and there by breaches or "passes," which give access to the enclosed lagoon.

Darwin's Theory of Coral Reefs

Barrier reefs of this kind do not occur around young and undissected volcanic islands, like Savaii in the Samoan group; but they are as a rule well developed around the dissected and embayed islands of the central Pacific; and this fact of distribution gives good reason for accepting Darwin's theory that the barrier reefs have grown up as their foundations slowly subsided; the presence of the upgrowing reef accounts for the absence of high cliffs on the sloping spur-end points. But it should be remembered that the simple physiographic principle of shore-line development, here involved, had not been recognized when Darwin announced his coral-reef theory in 1842. Bays were then commonly supposed to be the work of the sea.

Dana's Confirmation of Darwin's Theory

It was the American geologist Dana, Darwin's junior by four years to a day, and his follower as a young naturalist on the Pacific by about the same interval, who first taught that the sea tends to destroy bays by cutting away the headlands that enclose them, and that bays are as a rule produced by the partial submergence of valleys in an eroded land surface. This simple but fundamental idea in the evolution of shore lines came to Dana in 1839 while he was on a mountain in Tahiti, with the radiating ridges and valleys visible below him: he there saw that if the island were "sunk to any level above five hundred feet, the erosion-made valleys of Tahiti would become deep bays, and above that of one thousand feet, fiord-like bays, with the ridges spreading in the water like spider's legs"; and he explicitly stated that the prevalence of "bay-indentations in coasts as the terminations of valleys" on reef-encircled islands gave evidence of their subsidence (Geology, U. S. Exploring Expedition, 1849).

Reef-free Islands in the Coral Seas

There are, however, some exceptions to the general rule that embayed volcanic islands are encircled by barrier reefs. The Marquesas islands, for example, are deeply cut by valleys and the valleys are entered by bays, but encircling reefs are wanting; in their absence the spur ends between the bays have been cut off in high cliffs by the unimpeded waves, and beach-fronted deltas occupy the bay-head: hence the open embayments here do not give good harborage during on-shore gales. The same may be said of Tutuila, our member in the Samoan group, but there the cliffs are fronted by well developed fringing reefs: and these reefs suggest that the subsidence of Tutuila is of a more remote date than that of the Marquesas, where such reefs are not found.

It is, indeed, probable that the absence of a barrier reef around Tutuila today is due to the sub-recent subsidence of the island at a more rapid rate than that of reef upgrowth, for soundings lately made by our Navy Department show a well defined submarine bank several miles in width and of moderate depth all around the island and with an imperfect reef-like rim on part of its margin; and the best interpretation of such a bank is that it represents a submerged barrier-reef resting on an abraded platform. The few soundings that have been made around the Marquesas islands indicate the presence of similar banks there also. The conditions under which the cliffs of Tutuila and the Marquesas were cut have not been worked out, but

it is very possible that they were the same as those obtaining on Reunion and Tahiti.

Embayed Islands with Fringing Reefs

The greatest number of exceptions to the rule that embayed coasts in the warm oceans are fronted by barrier reefs are found in the Australasian archipelagoes: here indeed the rule seems to be reversed, for altho embayed coasts are abundant, they are usually bordered by fringing reefs, and barrier reefs are of relatively rare occurrence. This is well shown on the many excellent charts of the Philippines published by the U. S. Coast and Geodetic Survey within the last 15 years. The prevalence of fringing reefs appears to mean that, like Tutuila, many parts of the Philippine region have suffered subsidence at so rapid a rate that reef upgrowth could not keep pace with it.

Thus Palawan, the southwesternmost member of the group, has a wonderfully intricate shore line, especially in the neighborhood of Malampaya sound on its northwestern coast, where even fringing reefs are almost wanting, altho they have a width of one or two miles at the southwestern end of the island: but the coast is fronted by a submarine bank, 20 or 30 miles in width, varying in depth from 20 to 60 fathoms along its length, and with an imperfect, reef-like, submerged rim along its margin, thus suggesting the recent, rapid and unequal subsidence of a former barrier reef. On the other hand, Samar, the northeasternmost member of the group, has an embayed coast, with deltas in its bay heads and fringing reefs around its headlands, but without any submerged bank: here the submarine slope descends rapidly to profound depths.

Darwin on Fringing Reefs

It is therefore chiefly a mid-Pacific rule that embayed islands are surrounded by barrier reefs: but before describing those reefs further, let it be noted that the fringing reefs of Tutuila, of the Philippines, and of other similar examples, while contradicting one of Darwin's views to the effect that such reefs usually characterize stationary or rising coasts, nevertheless confirm another of his views that such reefs ought to occur on coasts that have subsided so rapidly as to submerge any pre-existent reefs.

This view is clearly stated in a seldom-quoted passage of his epoch-making book on the "Structure and Distribution of Coral Reefs" as follows: "If during the prolonged subsidence of a shore, coral-reefs grew for the first time on it . . . . these would necessarily at first belong to the fringing class" (1842, 124); but

no examples of fringing reefs thus formed were known to him; all the fringing reefs on his chart are colored red, as indicating non-subsiding coasts. His theoretical ideas here outstript his record of facts.

In view of the clear understanding thus shown of one of the possible consequences of his theory, it is curious that Darwin did not reach an equally clear understanding of the more essential consequence that is seen in the embayment of the shore line around a subsiding island. He recognized of course that the area and the height of the island must progressively diminish as it sinks beneath sea level, and he knew that certain reef-encircled islands are deeply embayed, but he did not see that the embayments are just as necessary a consequence of the subsidence of valley-furrowed islands as the loss of height and of area; and he thus lost one of the best confirmations of his theory.

Neglect of Dana's Confirmation

Strangely enough, Darwin seems never to have apprehended the relation between subsidence and embayments as explained by Dana, although in the second edition of his book on "Coral Reefs" (1874) he made use of the descriptions that Dana gave of various Pacific islands. Indeed the neglect of Dana's principle was very general in the discussion of the origin of coral reefs until about the end of the last century, when it was brought into notice by several new students of the old problem.

Inadequate Theories of Coral Reefs

One of the unfortunate results of the neglect was the promulgation of several still-stand theories of reef origin, which would not have burdened the literature of the subject had their authors understood the evidence that embayed shore lines give for subsidence. No less a personage than Sir John Murray, the distinguished naturalist of the "Challenger" expedition, noted especially for his studies of ocean-bottom deposits, was one of those who, overlooking the meaning of embayments, explained barrier reefs by outgrowth around stationary islands, the lagoon being dissolved out of the dead reef back of the growing front: and he maintained this explanation even for the barrier reef of Kandavu, a maturely dissected and beautifully embayed member of the Fiji group.

Murray's views are still frequently quoted, as if they were correct; yet a glance at a good chart of Kandavu or of many another reef-encircled island suffices to disprove them. There is good ground for the belief that, had Kandavu or any similar is-

land stood still during its long period of erosion, the detritus discharged in abundance from its valleys would have smothered any incipient fringing reefs that might for a time have grown on its rocky lava points, and that abrasion would thereupon have set in and the island would have been clift without embayments, like Reunion, instead of being embayed without cliffs, as is actually the case.

(To be continued)

THE GULF STREAM AND THE NORTH ATLANTIC DRIFT

By Genivera Loft
University of Wisconsin, Madison

Description of the Gulf Stream

THE stream of warm salt water which issues from the Straits of Florida and takes a northerly course along the American coast constitutes the Gulf Stream proper. At its exit from the Gulf of Mexico it has a width of about 50 miles, and a depth of 2100 feet. Its surface temperature varies with the seasons; in June and July it reaches 83° F., and in September it may be as high as 86°. In February the temperature is reduced to about 76°.

The velocity of the current is greatest along an axis, where it may be as high as 5.4 miles an hour. Each hour it pours 90 billion tons of water into the Atlantic from the Gulf of Mexico.[1] With its deep blue color, high temperature and salinity, and decided northerly current it has been recognized, ever since its existence has been known, as the most striking feature of oceanic circulation on the globe.

As the Gulf Stream continues northward from the Straits of Florida its width varies from 50 to 100 miles.[2] Its depth, as far north as Charleston, is 2400 feet. Off Charleston it shallows to about 1800 feet in its passage over the submarine plateau encountered there.[3]

As far north as Cape Hatteras the western boundary of the Gulf Stream is the 600-foot curve of the outer margin of the continental shelf. Between 37° and 38° N. the course of the current swings away from the coast to the eastward. During its passage along the southeastern coast of the United States the waters of the

1. Pillsbury, J. E., *Nat. Geog. Mag.* 23:1912:768.
2. Reclus, E., *The Ocean*, p. 71.
3. Agassiz, A., *Ann. Report Smithsonian Inst.*, 1891, p. 206.

Gulf Stream are prevented from swinging to the eastward and being dissipated in the open Atlantic by the warm water of that portion of the Equatorial Current which moves northward outside of the West Indies. It is because of its reinforcement by this large volume of warm water that the Gulf Stream is able to continue northward as a current and maintain its high temperature.

The rate of flow of the Gulf Stream differs considerably in various parts of the same section, and the velocity in any one part changes from time to time. The variations in rate of flow are greatest at the surface, and the greatest velocities occur at the surface also. Regular variations in velocity are the daily, monthly, and seasonal changes. Daily variations may amount to as much as 2.5 miles an hour. Less regular variations occur as a result of winds blowing over the surface of the water.

As the Gulf Stream continues northward its velocity decreases very markedly. Off St. Augustine it is seldom more than 4 miles an hour; and by the time it reaches the latitude of New York it is reduced to 2.5 miles. Off the Grand Banks it has a movement of not more than 1.5 or 2 miles an hour; and by the time it reaches 40° W. its current has become practically imperceptible.[1]

From Cape Hatteras the Gulf Stream proceeds northward and eastward meeting the Labrador Current off the coast of Newfoundland. The relative position of the two currents vary with their strength; the Gulf Stream is farther north from April to Sepember than during the remainder of the year, when it is pushed south by the Labrador Current from the north. The cooling of the warm moist air over the Gulf Stream by its mixture with the air from above the Labrador Current results in the heavy fogs which are a menace to navigation in this region.

The North Atlantic Drift

The westerly winds continue the movement of the warm waters of the North Atlantic and force them up against the continent of Europe. Beyond the Newfoundland Banks the Gulf Stream water constitutes a part of this North Atlantic Drift, which is carried northward and eastward, reaching from the Azores to beyond the British Isles and Scandinavia into the Arctic Ocean where its influence is felt as far as Spitsbergen. As far north as the warm surface drift continues its temperature is maintained at from 41° to 43° F. although the Arctic water in the same region may have temperatures ranging from 36° to 32°.[2]

1. Agassiz, A., *Ann. Report Smithsonian Inst.*, 1891, p. 206.
2. Pettersson, O., *Geog. Journ.* 11:1898:614.

The movement of the surface waters of the North Atlantic is quite different from the river-like course of the Gulf Stream near its source. It involves practically all of the surface waters of the North Atlantic and continues the transfer northward and eastward of an enormous quantity of heat received originally from the sun by waters in the torrid zone.

The depth of warm water increases to from 4,000 to 8,000 feet off the shores of Europe as a result of the forcing of the drift against the continental slope. The drift is divided by the obstruction which the continent constitutes, and a part of it is diverted southward. Depending upon their destination rather than upon their individuality as distinct currents in their trans-Atlantic courses, the following divisions of the drift may be distinguished: (1) The northern division which extends toward Greenland and a part of which enters Davis Strait and penetrates as an undercurrent as far as Baffin Bay; (2) The North European branch which continues in the direction of the Gulf Stream itself, making its way to the British Isles, the North Sea and beyond into the Arctic; and (3) the waters which extend in a more easterly course to the Azores from which region they are directed southward and become part of the Equatorial drift.

During the summer months the area of warm surface water in the North Atlantic is greater than in the winter when it is partially covered by cold water from the Arctic region. Not only is there a seasonal variation in the distribution of warm and cold surface waters, but there are considerable differences occuring from year to year. Pettersson found that in 1896 and 1897 the flow of warm water toward Spitsbergen was unusually strong and that in July 1897 the warm surface water extended over the entire distance from Norway to northeastern Spitsbergen. By November, 1897, the area of warm water in the North Atlantic and the Norwegian Sea extended from 59° to 75°N, and covered, according to Pettersson's estimate, an area of between 80,000 and 160,000 square miles. As a direct response to this came an extremely mild winter in northern Europe in 1897.[1]

Causes of the Gulf Stream

Naturally the explanations of the causes of ocean currents in general and of the Gulf Stream in particular have been various. Of all those advanced, the ones which have been most widely accepted are those which assign the chief place in the production of all ocean currents to differences in the specific gravity of the waters in different parts of the ocean, and those which refer to the winds as the chief motive power of ocean currents.

1. In loco cit. p. 615.

Captain Maury, U. S. N., who wrote during the middle of the last century, was the chief exponent of the specific gravity theory. The differences in density depend either upon differences in temperature or salinity. Although Maury's view received the support of a number of other oceanographers at the time it was advanced, it was never generally accepted. As was pointed out by Wyville Thomson it could not be accepted as an adequate explantation, since cooling in higher latitudes and its resulting high density would be offset by the high salinity and consequent high density in equatorial regions. This explanation would account for a state of equilibrium existing between the two regions rather than for the existence of a current from one to the other.

The explanation generally accepted at the present time is that advanced and upheld by Franklin, Herschel, Thomson and other students of the subject. It assigns to prevailing winds the chief part in the production of ocean currents and regards the Gulf Stream as the reflux of the Equatorial currents produced by the impinging of these currents on the continental uplift of South America and the West Indies.

The Trade Winds, blowing toward the equator from the northeast in the northern hemisphere, and from the southeast in the southern, produce a westward drift of waters in the equatorial region of both the Atlantic and Pacific oceans. In the Atlantic this consists of a broad belt of water on either side of the equator moving from Africa toward the western hemisphere. Were it not for the obstruction which is met with in the form of land masses, this movement of waters would encircle the globe; but its westward course brings it to South America and the West Indies. The portion of the drift which is produced by the north-east trades and is north of the equator is deflected northward; that of the south-east trades which is somewhat stronger because of the greater force of those winds, is divided by the nose of the South American uplift into two portions, the larger of which constitutes the Guiana current. The latter moves northward along the South American coast to augment the reflux of the North Equatorial current. Thus all the water of the North Equatorial current and a large portion of the South Equatorial current is directed from the tropics into more northerly latitudes; and a great quantity of heat is thus transferred from regions where heat is in excess, to areas where its addition is highly beneficial.

A portion of the volume of the equatorial waters is deflected into the Caribbean Sea and thence through Yucatan Channel into the Gulf of Mexico. The remainder flows northward outside of

the West Indies and joins the Gulf Stream proper north of the Bahamas. Since the passages through which the waters leave the Caribbean and the Gulf of Mexico are much narrower than those through which they enter, there results a banking-up, so that the surface level is raised above that of the open Atlantic. This retardation of the waters in tropical regions results in their temperature being increased, that of the Gulf of Mexico reaching as high as 86° in September. The elevation of the surface results in the development of hydrostatic pressure which adds to the momentum with which the waters are sent out into the Atlantic through Florida Straits. The force with which the waters are directed from the Gulf is sufficient to carry the Gulf Stream as far as 40°W. long. in the region south and east of the Grand Banks, where its existence as a separate and distinct current may be said to terminate.

Although it exhibits variations which are due to other causes, such as differences in density, depending upon temperature and salinity, the Gulf Stream exists primarily as a result of the movements of surface waters produced by the trade winds blowing over the Atlantic Ocean. The course of the Gulf Stream is determined by the outline of the coasts against which it is directed and along which it flows and to such other influences as the rotation of the earth and the prevailing westerlies.

The circulation of the waters of the North Atlantic continues the movement by which warm water from the equatorial region is carried into northerly latitudes. The prime factor in this movement is the westerly winds. Because of these winds the water is drifted eastward and northward; and eventually the heat which it contributes to the air above its surface is carried to the land.

Professor H. N. Dickson under whose direction extensive investigations concerning the circulation of the waters of the North Atlantic have been carried on, says in regard to this circulation, "It is the result of a large number of factors each of which is subject to a wide variation. The mean result shows that oceanic circulation is directly controlled by the winds, the form, position and intensity of the whole of the Atlantic anti-cyclone and the cyclonic area to the north of it being taken into account. The movements of water set up directly by these systems is modified by, firstly and chiefly, the configuration of the land, and secondly by the effects of melting ice."[1]

Effects of the Gulf Stream on Climate

In the popular mind the Gulf Stream is always associated with the climate of northwestern Europe which is so surprisingly

1. Dickson, H. N., *Phil. Trans. Roy. Soc.*, 1901: 196:108-109.

mild considering the latitude of the region. Whether we call the movement of waters, which carries this heat northward and from which heat is transferred to the land by the wind, the Gulf Stream, or the North Atlantic Drift, its effect on north European climate is exceedingly marked and, to the highest degree, benificent. The drift which extends across the Atlantic consists in part of water brought from tropical regions by the Gulf Stream and its heat thus helps to moderate the climate of Europe, although its original momentum does not carry it to European shores.

Croll has estimated that the heat which is carried north by the Gulf Stream alone is over a fifth of all that received by the North Atlantic and that it is equal to all of the heat received from the sun by a belt 32 miles wide on either side of the equator.[1] This heat transfer keeps the temperature of tropical lands lower, and of more northerly regions higher, than would otherwise be possible and is therefore beneficial in low as well as high latitudes. The heat which is carried northward would have little effect on land temperatures were it not for the winds by which it is transferred landward. Winds alone, however, could not transfer this heat from tropical regions to higher latitudes since there are no winds which continue at the surface from equatorial to polar regions. The heat is carried from the tropics by wind-produced currents, and later, when the heat is transferred from the water to the air above it, the wind carries this heat to the land.

As the warm waters from the Equatorial drift move northward their surface layers are cooled and their density is thus increased. As a result their place is taken by lighter, warmer waters from beneath. In this manner the entire mass of warm water gives off heat to the air above it. The Gulf Stream, as has already been pointed out, is able to maintain its temperature at a comparatively high point as it proceeds northward only because it is reinforced by the warm water of the portion of the Equatorial current which passes to the east of the West Indies. The Gulf Stream itself, instead of being "well equipped on starting on its long journey with an inexhaustible supply of salt and heat, actually does not start with as much as might be picked up anywhere in the Atlantic between Bermuda and the West Indies or our Southern States; moreover, it carries the best part of its supplies on its surface, where, by diffusion and dilution, they are liable to be soon dissipated."[2]

1. Croll, Jas., *Climate and Time*, p. 27 and 35.
2. Lindenkohl, A., *U. S. Coast & Geod. Sur. Rept.* 1895. App. 6, p. 366.

The convection currents which are set up in the water as a result of the surface cooling result in the temperature of the water being fairly uniform throughout its depth. The Challenger Expedition found that the daily range of temperature of the surface waters of the North Atlantic was only 8°F. while that of the air above it was four times as great.[1] The effect which the transfer of heat from the water to the air above it has is manifested very strikingly in the remarkable degree to which the trans-Atlantic isotherms parallel the Gulf Stream and its extension in the North Atlantic drift. The isotherms show variations according to the temperature and position of the Gulf Stream, the 70° isotherm for February extending as far north as 40° while that of August reaches 50°N.[2]

The loss of heat which the northward moving waters undergo off the American coast has no important effect upon the climate of Eastern United States, since the prevailing winds blow off-shore and carry the liberated heat seaward. Heat is given off more rapidly as the warm surface waters spread outward, but as far north as 36° the temperature of the Gulf Stream may be 74°F. while the sea beyond is only 62.5°. In latitude 40° to 41° its temperature may be as high as 72.5° with that of the water beyond it only 63.5°.[3] The difference in temperature between the waters of Europe and those in the same latitude off the American coast is striking. The mean sea temperature off the Hebrides is over 47° above that off the American coast in the same latitude and in the course of the Labrador Current.[4] The influence of the warm water is sufficient to prevent ice from forming in the Norwegian fiords except in those parts where the inner portion is cut off from the circulation of oceanic water by a submarine sill; and its influence is extensive enough to reach into the Arctic Ocean where it keeps parts as far north as 80° free from ice during the greater part of the year, while those of Greenland in the same latitude are never completely free from ice. On the southwest coast of Iceland, against which the warm waters are directed, are the two only ports of the island which are always open so that fishers may venture forth during all parts of the year.[5]

A comparison of land temperatures shows that those of latitude 52°N. in the western part of the British Isles average as high as those in the eastern United States 14° farther south or

1. Murray, Jno., *Geog. Jour.* 12:1898:128.
2. Murray and Hjort, *Depths of the Ocean.* p. 705.
3. Thomson, Wyville, *The Depths of the Sea.* p. 386.
4. Ibid. p. 362.
5. Irminger, C., *Proc. Roy. Geog. Soc.* 5:1861:234.

nearly 1000 miles nearer the equator. The average annual temperature of Dublin is exactly the same as that of Boston, although the latter is 11° nearer the equator than the former.[1]

To the heat which is brought northward by the currents and drifts of the North Atlantic is due the comparatively high temperatures of the British Isles which would otherwise possess a climate much like that of southern Greenland. It is estimated that the January temperature of London is 24°, of Edinburgh 30° and of the Shetland Islands 36° higher than can be accounted for by latitude alone.[2]

Investigations carried on in the Faeroe Islands show a great variation in air temperatures resulting from the direction of the wind. When the wind comes from the southwesterly quarter and brings the warmth of the surface waters with it the temperature may be as much as 43.7°F. higher in the winter and 34.7° higher in the summer than when the wind blows from the north, bringing with it the effect of the Arctic East Iceland drift.[3] The influence of the warm water is sufficient to keep the lakes of the Shetland and Faeroe Islands from being closed by ice during the winter in spite of their high latitudes.

The work of Pettersson, Nansen, and others, on Norwegian coast climates and their relation to the temperature of the sea shows clearly the influence of the temperature of the ocean water upon the land to the leeward. They found that when the water off shore was comparatively warm in February the flowering of certain plants began at an early date and that the snow disappeared and farmers were able to begin farm work sooner than when the water showed a comparatively low temperature. Investigations on the rate of growth of pine trees showed that their growth registered the influence of the water temperature of the year preceding the one for which the growth measurement was taken in each case. The high temperature of the ocean waters of May, 1905, had its manifestation the following year in an unusually great increase in the height of pine trees. Likewise the abnormally low temperature of the surface waters in 1902 was followed by a very slight development of the pines in the growing season of 1903. The retardation is due to the fact that the growth of the pine for any one year is affected by the conditions under which the bud is produced during the preceding year.[4] The results obtained by these studies make it seem probable that further investigation will make it possible to predict general

1. Thomson, Wyville, *Depths of the Sea.* p. 363.
2. Buchan, A., *Jour. School Geog.* 2:1898:362.
3. Irminger, C., *Proc. Roy. Geog. Soc.* 5:1861:234.
4. Murray and Hjort, *The Depths of the Ocean.* p. 300-302.

weather conditions for this region several months in advance with a fair degree of accuracy.

Other Influences of the Gulf Stream

Since temperature is one of the factors which determine the distribution of life in the ocean water, it is evident that the influence of the Gulf Stream must be an important factor in oceanic ecology. In its waters are many forms of animals which would be unable to exist in such northerly latitudes outside of its course. The Nantucket whalers long ago recognized its influence on the distribution of whales none of which were found to inhabit this warm stream although they were found on either side of it. As its temperature is lowered in higher latitudes the tropical fauna disappear and those of intermediate latitudes take their place. In the inner basins of those Norwegian fiords, which are separated from the oceanic circulation by a submarine sill, occur purely Arctic animals, while in the seaward portion of these same fiords are found animals characteristic of more southerly regions. East of North Cape, where the fiords are all open arms of the sea, the two types of animal life are found together with the purely Arctic type preponderating and increasing eastward, until, where the Gulf Stream influence is finally dissipated entirely, it forms the only life. During the winter the area of the warm surface waters of the Atlantic is decreased by the invasion of Arctic waters which partially cover them; and as a result, there is a considerable migration of fishes from the north to the warmer waters. The winter herring fisheries of the Scandinavian coast are possible because of this migration.[1]

Any great or sudden change in the relative position of the warm and cold waters of the ocean may result in great destruction of life among oceanic animals. In 1882 as a result of heavy northerly winds, the area of warm water was decreased and the tile fish of the region affected were destroyed in enormous numbers. It was estimated that all the fish were killed in an area of from 5,000 to 7,000 square miles, and that the number of dead fish must have been at least one billion.

Influence on Navigation

From the beginning of trans-Atlantic voyages the Gulf Stream has influenced the course taken by vessels sailing between Europe and North America. Columbus was the first to

1. Pettersson, O., *Geog. Jour.* 11:1898:614-615.

make use of its current, and by means of it he was able to avoid the calms north of the trade wind belt. From that time on it was recognized as an important factor to be reckoned with in North Atlantic navigation, but it was not until the time of Benjamin Franklin that even the most elementary scientific study of the Gulf Stream was undertaken. Franklin's attention had been called to the fact that the New England trading vessels made better time in trans-Atlantic service than did the Royal Mail packets. From the captains of whaling vessels he found that it was because the American vessels made use of the Gulf Stream in going to Europe and took a course which would avoid its adverse current on the return voyage. From information received from the captains of Nantucket whalers Franklin published a map of the current about the year 1770. His suggestion regarding the use of the thermometer to determine the limits of the Gulf Stream was particularly useful, since the primitive instruments in use at that time did not allow a mariner to get his location with any degree of safety. By means of the thermometer vessels sailing off the southeastern coast of the United States could be kept within its current and hence be safe from the dangers of shallow water nearer shore. With the introduction of more exact nautical instruments the usefulness of the Gulf Stream in this respect came to an end, but it still had to be reckoned with on account of the force of the current itself.

SUMMARY

(1) The Gulf Stream is a part of the reflux of the equatorial currents caused when the trade wind drifts impinge on the continental slope of South America and the West Indies.

(2) The Gulf Stream proceeds northward from the Gulf of Mexico to latitude 37°-38° and then swings eastward to longitude 41° to 40°W. south of the Grand Banks.

(3) From this position its waters form part of the North Atlantic drift, which moves under the influence of the westerlies.

(4) The Gulf Stream is one of the agents by which a great quantity of heat is transferred from the equatorial regions to higher latitudes.

(5) Since it contributes warm water to the North Atlantic drift the Gulf Stream is indirectly one of the causes of the mild climate of Northwestern Europe.

(6) In addition to its effect on land temperatures, the Gulf Stream exerts an influence on navigation and on the distribution of oceanic organisms.

COMMERCIAL GEOGRAPHY FROM THE REGIONAL POINT OF VIEW*

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MY conception of the unity of geography rises in rebellion at the division of geography into the parts that are implied by the use of such terms as mathematical, physical, political, and commercial geography. Such words hark back to the time when the early facts of geography were being accumulated and were so classified because the relationships which now unite all these diverse facts into a connected science were not then known and no better basis for classification existed. I have little sympathy with the all too prevalent notion that geography is a hodge-podge of facts drawn from every science and field of knowledge and that any body of facts can be lifted bodily out of the larger body of facts and relations which today constitute geography and be thus studied separately and apart as is implied by the term "Commercial Geography."

It is, however, a condition and not a theory which we are facing, and the fact remains that there *are* courses in many high schools known as courses in Commercial Geography. Whatever they may be called, the far more practical question has to do with how they shall be organized and taught so as to accomplish the end most to be desired.

PREVALENT REASON FOR TEACHING COMMERCIAL GEOGRAPHY

I suspect that Commercial Geography found its way into the high school and maintains its place there in response to the almost universally popular demand that education shall be practical and utilitarian or shall have bread-and-butter value. I am not out of sympathy with this point of view but there is a grave danger that in our eagerness to teach things in the school which shall later in life be found to have practical value we shall forget the needs of the boys and girls here and now. I must not become so interested in what my boy is to become eight or ten years from now that I forget the process of his becoming. In other words, the end of education is not knowledge but growth and development, and the subject matter used is far more important when viewed as a means to this end than when viewed as an end in itself.

* A paper read before the Michigan School Masters' Club, Apr. 1914.

I feel therefore that the average superintendent or high school principal believes that Commercial Geography is in the high school curriculum for the very practical purpose of giving a knowledge of the great raw materials of trade, the processes by which and the places in which they are prepared for use and the commercial routes over which they are transported to market. The most direct and certain method of accomplishing this result seems naturally to organize that subject around the commodities and products which enter so largely into the world's trade. If much of this work has not already been done in the grades then high school geography should do all of this, but it should do far more.

Larger Considerations in High School Geography

In these strenuous and trying times when every form and type of civilization is being tried and tested by the fires of war, something more is demanded of high school geography than that it merely teach commercial commodities and products and the processes by which they are prepared for use. When we are wondering whether the individuals which compose the great democracies of the world are going to stand the strain of war because they are intelligent enough and clear thinking enough to see the issues involved or whether they are going to "blow up" as the Russians have done because they cannot think far enough to see the consequences of their own acts, it behooves us to consider well the end and purpose of every subject in the school curriculum. Shall we ask high school students of geography to study commodities and products, commercial and industrial processes, or to consider some of the more fundamental relations and issues which arise from particular peoples and nationalities inhabiting certain definite regions and types of physical environment? It is out of such relations that arise the issues of national life and death such as are at stake in the world-war now waging, and it is with such relations that high school students should be given some opportunity of dealing before they meet them in actual life.

Commerce, as I see it, is the exchange of ownership and the transportation of goods and commodities between different parts of the same country or between different countries. It is a mental response or adaptation which men have devised to meet and satisfy the diversity of needs and wants arising out of the diversity of occupations caused by the responses of different groups of people to varying conditions of physical environment. As a consequence, there has resulted a most wonderful specialization of industry and production thruout the world.

The Importance of Transportation

Such inter-dependence could not exist were it not for the efficient machinery of transportation that has been developed. Without transportation the world would soon fall back to a condition of society in which each community or family group would have to be its own butchers and bakers and candlestick-makers, if they did not even return to a savage state in which all of their wants were supplied by hunting them in nature. Indeed, the best test of the efficiency of transportation is the degree to which it permits a people to specialize in the production of things which they and the region in which they live are best fitted to produce. With cheap, quick transportation California is thus able to produce fruit for a whole continent, Argentina and Australia, beef and mutton for a hemisphere on the opposite side of the equator, and Brazil, coffee for the whole earth.

The Regional Organization of Commercial Geography

If commerce and trade grow out of the various ways in which a diverse people living under different conditions of environment gain their living from their surroundings, then to understand commerce and trade and the commodities exchanged, such peoples must be studied in the midst of the particular environments in which they live. Commerce and trade are therefore the culminating topic in the study of the geography of any region. For this reason the regional organization of commercial geography is the more natural, and the more logical, as well as the more valuable because it furnishes a background and basis for understanding the great world happenings and events which grow out of geographic conditions.

By the regional organization of commercial geography I mean such a study of a region that the student will see the causal relations of its position, form, size, and surface to its climate, and then of climate and soil to vegetation, and of vegetation and all of the preceding factors to occupations, distribution of population and commerce or trade.

Such a treatment of commercial geography does not and should not exclude the study of commodities and production processes, but subordinates their study to that of the regions in which they are produced. If an intensive study of commodities is desired then make it in the region which is so well fitted either physically or humanly that it ranks high in the production of that particularly commodity. Later it may also be studied comparatively, both as to quantity produced and process of production in other regions.

The Teaching of Industrial Processes

I have mentioned production processes and in passing wish to emphasize one point concerning that topic. It is a phase of grade and high school geography that I believe is generally overdone. It is not the business of geography to teach technical or mechanical processes of production. Such technical processes find a legitimate place in geography only when the process itself is determined by the geographic conditions of the region in which it is carried on or when the process is such as to determine the localization of the industry or commodity studied. The kind of production processes that legitimately belong to geography is well illustrated by the nitrate industry of Chile.

After the location and cause of the desert in which the nitrate once accumulated have been described and explained and after it has been shown how the existence of a soluble salt such as nitrate of soda, above the water table in the ground is due to the arid climate of the desert, the response which people make to the existence of such a valuable deposit is the next logical and natural question to be raised. The student should then work out that the crude nitrate as dug from the ground contains so much insoluble and waste matter that it is not profitable to transport it in the crude state to its distant markets in the northern hemisphere; that it must be refined near the desert where it is mined; and that the refining process consists of two steps, first dissolving the nitrate in warm water and then evaporating the water until the nitrate is precipitated from solution to the bottom of large tanks. For this step fuel and water are required, but both are lacking in the nitrate desert. The visible supply of nitrate is large enough, however, to justify the expense of laying pipe lines from the mountains, a hundred or more miles away. Coal is obtained from England or Australia because the sparse population of the nitrate region has so few needs and wants that captains of vessels going to the nitrate ports would rather carry coal at a low rate than to go empty or in ballast. Coal is therefore cheap in the nitrate region and the refining process is carried on in this most desolate of deserts. The demand for labor created by the localization of the nitrate industry here, has caused the growth of modern cities with popu- or more miles away. Coal can be brought from England or Aus- lations as great as 50,000 people.

Such a treatment of production processes is legitimately geography because such processes are determined by geographic factors and conditions. The various steps in the assembling of an automobile or the making of boots and shoes have no place in

geography except to show that they must all take place near each other and hence in one factory which thus calls for concentration of population forming the manufacturing type of city.

Regional Treatment Illustrated

At the risk of repeating some very elementary geography that is familiar to you all, let me now illustrate concretely and with the aid of these maps the sort of regional treatment that should precede the study of commodities or industries in a region such as Asia.

The first and most important fact in the geography of Asia is that it is a *large* continent lying chiefly in the *north temperate zone.* As a result, in central Asia the sun in summer rises far to the north of east, culminates high above the southern horizon in the sky at noon, and sets after an apparent journey of 15 or 16 hours across the sky, far to the north of west. As a result of the steeper rays, longer days, and shorter nights, the temperature of both land and sea begins to rise with the approach of summer. Since land heats more rapidly than water, central Asia becomes much warmer than the surrounding seas, especially those to the east and south. As a consequence, the air over Asia heats, expands upward, and flows out aloft from over the continental interior producing low pressure over the land and high pressure over the sea, so that the winds of Asia in summer blow from sea to land and are known as the summer monsoons. In winter the winds are reversed and blow from land to sea.

With such winds blowing over Asia the next factor that must be introduced before the distribution of rainfall can be understood is surface.

The Use of Maps

Permit me to digress enough to say that another reason why I should make commercial geography regional in character is the opportunity it offers high school students to use maps. By the use of maps I do not mean simply the finding and location upon maps of the places which they run across in their text, but the actual reading of maps or the translation of map symbols into spoken or written thoughts that shall express the great fundamental facts concerning the surface and drainage of a region and the distribution of its rainfall, vegetation, and population. Such exercises in map reading have all the value that was formerly supposed to be attached to translation in the study of foreign or ancient languages. In addition they have the advantage of fixing in the mind the facts which they represent, for it is said we remember 10% of what we hear, 15% of what we read

and 20% of what we see. I have yet to find the high school student in my normal school classes that will not stand mute and dumb when asked to read the simplest facts from such maps as these.

From the maps representing surface winds and rainfall, it is easy to read and understand that the maximum rainfall of Asia comes during the summer half of the year, is heaviest around the borders, especially in the southeastern part, and is least—less than 10 inches—over must of the interior and the southwest.

Comparing rainfall and vegetation maps it is evident that the amount and seasonal distribution of rainfall are the most important factors in determining the distribution of woodlands, grass lands, and deserts within the continent.

When mankind is created or migrates into such a continent as Asia there will be a close correspondence between the density of its population and its food-producing capacity as expressed by the map of its vegetation.

Influence of the Environment

The type of life lived by Asiatic peoples is again determined by vegetation. The wandering, nomadic life with all that that means in determining ideals, morals, industry, and trade, is forever predestined in the steppes and desert regions of the interior except in those limited areas where irrigation is possible. The sedentary life will obtain in those regions whose greater food-producing capacity is reflected in their greater luxuriance of vegetation.

Mountains and desert barriers assert themselves by isolating certain peoples, causing the development of different races, and national groups as shown in part by the political map. Behind these physical barriers people not only develop racial and national peculiarities but also specialize in production and industries to such a degree that commerce with other groups finally arises.

The Case of China

When such intercourse arises it often happens that race characteristics developed during the period of isolation are obstacles to migration into other regions. Thus the Chinese under the stimulus of a rich soil, warm temperature, heavy summer rainfall, and a dense population, have developed virtues of endurance, industry and thrift which are as much of a barrier to their admission to other lands as are their low standards of living. They therefore remain in China with their population growing denser and denser until cheap labor is their one great

surplus which they have to offer to the other regions in the form of silk, and tea—two products which can be produced in other lands as well as in China, but which are there handicapped by the lack of an adequate supply of cheap labor. In such a setting the detailed study of silk and tea and other commodities may then be taken up with the hope that the student already knows some of the determining factors which influence their production.

China is still in spite of its many years of history, industrially young and therefore an exporter of raw material and certain food products and an importer of manufactured goods. It has within it however all the conditions save one for becoming very rapidly industrially old and an exporter of manufactured goods when the industrial revolution which took place in England a century ago shall have taken place there. With the largest untouched coal fields of the world, with abundance of iron ore, and a cotton producing area that rivals that of the United States as well as other raw materials, and with an unlimited supply of wonderfully cheap and industrious labor, China lacks only an efficient system of transportation to make it quickly into a manufacturing country. When that awakening comes there will arise such a crop of economic and political problems as will keep its own and the statesmen of other nations busy for many years to come.

The Superiority of Regional Treatment

It is because so many political and international questions and issues strike root into geographic conditions that the regional organization of commercial geography is to me superior to its organization around commodities. I cannot see how the latter organization can ever make clear to students unless it be dragged in by the heels, the geographic factors that have operated to cause such a war as the present one. But when the countries at war are considered as regions how inevitably do the influencing factors stand out. Germany came late into the family of nations,—long after the world had been partitioned among other nations. She therefore had no important colonies as sources of food supply and raw material and yet she was rapidly becoming industrially old so that she could no longer feed her rapidly growing city population with the products of her own fields but was forced to import twenty-five percent of her food supply from abroad. To acquire and control the sources of her own food supply seemed to be the only guarantee of continued national existence, but the only way they could be acquired was to take them by force. To this end was shaped her philosophy that might make right. To this end did she build her navy, train and

equip her army and begin the war. To this end did she rush across defenceless Belgium to seize the rest of France's coal and iron fields that were left after 1870 and to this end do her armies continue to advance into the heart of Russia after the treaty of peace has been signed.

A recent letter from a little German girl to a Swiss girl published in the Red Cross Magazine represents the former as saying, "Some years ago my father said to us, 'Children, Germany is getting too small for us; we shall have to go to France again in order to find more room.' " and she then adds, "Is it our fault if France will not understand that more money and land are necessary to us." Surely it is not Germany's fault if France and Russia and England did not understand that Germany needed more room. But was it not the fault of French and Russian and English and American schools that the people of these countries did not understand that Germany needed more room and was preparing to take it by force. I believe that geography can be so taught as to enable boys and girls to think along these lines in school and thereby to deal more intelligently with them as the citizens of tomorrow. To me the regional organization of geography lends itself far more easily to such teaching than does the commodity organization. Such teaching may not have bread and butter value but it has a life and death value when nations grapple in such a struggle as the one in which we are engaged and the clear understanding of the issues involved becomes necessary.

PEARLS

SINCE ancient times pearls have been a highly valued commercial product. Records dating five hundred years B. C. show that the fisheries of Ceylon were at that time well developed. They were in high repute in Rome at the time of Pliny; in the thirteenth century Marco Polo visited them. Practically all the well known early American explorers found the Indians wearing pearls which they would trade for mere trinkets.

In Lower Californian Waters

Even now pearl fisheries are being operated in the Gulf of California near La Paz and on the seaward side of the peninsula of Lower California. Pearls seem to thrive best in protected harbors and inlets into which a fresh-water stream empties. These fisheries have been worked for about forty years by San Francisco firms under a Mexican concession. Due to the dan-

gerous currents, the diving must take place only from one and a half hours before to one and a half or two hours after the turning of the tide. There are from 800 to 1200 divers employed in these fisheries. Their monthly salary is one-tenth of the catch which sometimes amounts to $500. The shells which are valuable for buttons and for mother of pearl are sent to San Francisco; the pearls go to Mexico City and Paris. In 1908 the output was valued at $5,000,000; $3,000,000 of this consisted of the shells. Two exceptionally fine Mexican pearls sold one for $10,000 and one for $25,000.

Australian Pearl Fisheries

The pearl oyster grounds of Australia are the most extensive in the world; they extend in irregular patches for 3,000 miles off the coast of Queensland, Western Australia and Southern Australia. In 1905 about 800 ships and 6,000 men were employed in securing $1,700,000 worth of shells and pearls. The finest mother of pearl comes from here and exceeds the value of the pearls by 300 per cent.

The Ceylon Fisheries

Ceylon, however, always has been and still is the great center of pearl fishing. The pearling area covers about 800 square miles in the Gulf of Manaar between India and Ceylon. The grounds are concentrated on banks which occupy a shallow, level plateau, extending from three to twenty miles from shore. The oysters which are really a kind of mussel are attached to calcareous rocks or dead coral.

During March and April when the northeast monsoon is waning and the southwest monsoon has not yet started, the fishing is carried on, because during the windy weather the currents make diving dangerous. Up until the last few years the English government regulated the fishing. Officials on a government boat made an estimate of the number of oysters and of their value. The fishing boats then went out to the grounds in squads of 50 to 70, each carrying 10 or 12 divers who work in pairs. From sunrise till noon the divers are constantly busy, each diver making from 40 to 50 descents each morning. At the noon signal all diving ceases and the boats race back to the shore to deposit and sell their catch. In a government corral the oysters of each crew are divided into three piles, the government takes two and the divers and crew take the other. The government's share of oysters is sold at auction in large quantities. This stimulates much gambling because the number and value of the pearls in the oysters are, of course, not known.

Manchchukaddi is the pearl town of Ceylon. Here Arabs, Malays, Hindos and peoples from the Yellow to the Mediterranean Seas congregate to fish, to buy, and to gamble. At the opening of the fishing season this city suddenly springs up and contains 40,000 to 50,000 people. When the fishing is over, however, they all leave and the city is left a barren waste, perhaps until the following year or perhaps not until several years later when the fishing is again deemed profitable. The supply has always been irregular. During the nineteenth century there were only thirty-six years when fishing was possible.

In 1905 the greatest output on record was made. The 318 vessels which were used brought up 81,000,000 oysters, almost twice as many as were ever found before. The average price was $16 per thousand but through reckless bidding the price rose to $30 to $40 per thousand. The yield of pearls in this year amounted to $1,300,000. Since that there has been a slump in the output. The shells for mother of pearl sell for $20 to $30 a hundred pounds. The annual revenue of the British government of India from the Ceylon pearl fisheries amounts to $500,000 to $750,000.

FLORENCE WHITBECK.

CUBA

CUBA is really a great garden lying ninety miles east of Key West, Florida. The island is seven hundred and eighty miles long and varies in width from twenty to a hundred miles. It has two thousand miles of coast line and a total area of about forty-five thousand square miles. With the exception of the northern part of Maine, which to-day is practically uninhabited, Cuba is as large as the whole of New England put together. Before one visits Cuba, he has little impression of the size of the island. I had not realized that it takes twenty-four hours by train or forty-eight hours by steamer to go from Havana to Santiago on the other side of Cuba. The island is somewhat mountainous, for all the West Indies are simply the tops of a high range of subterranean mountains projecting above the surface of the sea. About one-fifth of Cuba is mountainous. Of the rest of the country, three fifths is made up of fertile plains, with scattering hills and valleys, and about one-fifth is swampy.

Cuba is sometimes called the "Island of a Hundred Harbors" and certainly she is greatly blessed with harbors, which, by the way, are very scarce on the coast of South America. More than fifty harbors are ports of entry, many of them deep and pouch shaped, with narrow entrances completely land-

locked. The entrance to the harbor of Santiago is the most remarkable I have ever seen. The city is absolutely invisible from the sea, being approached, only through a long, tortuous channel, six miles in length, the sea opening being only six hundred feet wide. Certainly the chief cities of Cuba have been determined by the harbors, of which that of Havana is the best. The entrance is only one thousand feet wide. Good harbors make good cities, hence as one travels along the coast of Cuba and sees a fine harbor, he may be sure that some day a large city will develop there, even though only a few negro huts are to be found now.

Winter in Cuba is like our April and May; and summer like our July and August—only hotter. However, it is always possible to get into a breeze. The heat is greatly tempered by the wonderful trade winds which blow from the northeast with but little variation throughout the year. The nights, during both winter and summer, are cool. Unfortunately, however, the sections of the island which present the greatest opportunities for making money are also the most unhealthful. This applies especially to the coast line during the summer season. Yellow fever has been stamped out to a great extent, but malaria still rages.

In spite of these drawbacks natural to a tropical country, Cuba is one of the most healthful countries of the world. The mortality among the two million five hundred thousand inhabitants in a recent year was only 12.6 per thousand, which was lower than that of any other country for that year except Australia, where the death rate was the same.

Havana, the capital of Cuba, is the largest and most prosperous city, has the best situation, and is, I believe, destined to retain its leadership. Its streets, although still narrow, have been paved and asphalted. There are electric lights, sewers, municipal water, and other improvements. Its wide boulevard —the Prado—which stretches along the water front, is unexcelled, and there are as many automobiles as on the boulevards of an American city, while the stores of Obispo Street are noted among connoisseurs of jewelry, laces, and other articles of adornment. The deposits and homes of the leading banks are worthy of any large city, as are the libraries, schools, churches, theaters, and newspapers. High office buildings are now being erected. Even baseball is played with enthusiasm! The American business man is lunched at as beautiful a clubhouse as can be found in any American city, while the newsboys are as active in selling the daily papers as on election night on Broadway.

The hotels are good, and of course cigar factories are found everywhere. Moreover, Havana has most beautiful and interesting suburbs which are reached by electric lines, as are the suburbs of so many of the larger American cities. Although formerly surrounded by a high wall, Havana has recently expanded greatly in size and now contains a population of about five hundred and fifty thousand.

Cuba is immensely rich in its natural resources. The annual sugar crop is worth over one hundred million dollars, the tobacco crop about thirty-five million dollars; citrus fruits are produced to the value of ten million dollars, and pineapple, cacao, honey, asphalt, iron, henequen, mahogany, cedar, and the like yield ten million dollars. Iron is the chief product in the field of minerals, and here were found the great cliffs of iron ore which were afterward purchased by one of the great independent steel companies of our own country. [From Babson's *The Future of South America.*]

RELATION OF THE MOON TO THE TIDE*

THE influence of the moon on the tides takes place in three leading periods or months of different lengths:—(1) The well-known month of the moon's phases (synodic month) from new moon to new moon. (2) The month of the moon's distance (anomalistic month) from perigee to perigee. (3) The month of the moon's declination, north and south of the equator; the declination being another word for the same thing as latitude on the earth. Just as the sun crosses the equator twice in the course of the year and goes north in summer and south in winter, so the moon does in the course of the declination-month. There is thus a time in each month when the moon rises to a high altitude on the meridian; and it falls to a low meridian altitude half a month later. The three types of month above mentioned, has each its own special length, the first being the longest; and they therefore over-run each other.

The most important fact to note is that these various movements of the moon have not the same relative effect upon the tide in different regions of the world. As a rule, in any particular region, some one of these movements has so preponderating an effect that the influence of the others is obscured. Or, it may be that two of them have a nearly equal effect and the influence of the third is difficult to detect.

* *General Description of Tides.*—Issued with the "Pacific Tide Tables," by the Tidal & Current Survey of Canada.

In the North Atlantic, the most marked feature of the tide is the variation from springs to neaps in accordance with the moon's phases. But to assume that this must be the leading feature everywhere in the world, and that for practical purposes all other influences may be ignored, is a mistake which has placed a serious obstacle in the way of the correct understanding of the tides generally. Even on the borders of the North Atlantic the springs and neaps are not always dominant; as in the Bay of Fundy, where the variation in the range of the tide with the moon's distance is distinctly greater than the variation from springs to neaps.

When the moon is at its extreme declination, north or south of the equator, its attraction is oblique to the plane of the earth's equator, which gives rise to diurnal inequality in the tide. Almost everywhere, there are a few days, twice in the month, when this inequality is quite noticeable. In some regions it may besome very large, as in Northumberland strait, where the difference in range between the two tides of the day may be half as much again as the true difference between springs and neaps. On the Pacific coast, the moon's declination is the dominant element. In Fuca strait and the Strait of Georgia the resulting inequality becomes so developed that it obscures every feature in the tide. When the moon is on the equator, the day and night tides are equal in range; but as the moon's declination increases, it gives rise to one pair of large tides, while the other two tides of the day are reduced to half tides. The time-interval from one tide to the next also becomes unequal. It is only when the moon is on the equator that successive high waters are equally spaced in time. After that, the intervals between them become shorter and longer alternately, until the moon reaches its maximum declination, when the intervals are the most unequal.

In regions where declination is thus the dominant element, the change in the declination of the sun during the course of the year, may have a greater effect than any other of the moon's own motions. There is accordingly a marked annual variation; as the largest tides, due to inequality, must occur when both the sun and the moon are north or south of the equator at the same time. Hence the extreme tides of the year occur at the moon's maximum declination which is nearest to the solstice, in summer and in winter.

The currents in the passes in British Columbia are affected in the same way as the tide itself. It is only when the moon is on the equator that the tidal streams in the two directions run for the same length of time and with the same strength. Otherwise

they show an inequality which becomes greatest when the moon is at its maximum declination, when the long run and the short run become the most unequal. To show when this occurs, the dates at which the moon reaches its maximum, north and south of the equator, are indicated in all the tables of slack water.

It is thus evident that a truly average tide can only occur midway between springs and neaps, at a time when the moon is on the equator and also at its mean distance. Of all the variations from this average, the greatest by far occurs in regions where diurnal inequality is the dominant feature in the tide.

CURRENT MATERIAL FOR THE GEOGRAPHY TEACHER

America's Huge Rubber Industry

Automobile Tires made in the United States consume half the World's Supply of crude Rubber.

THE United States finds itself today the chief market for crude and plantation rubber and the principal manufacturing center for the many important products made wholly or in part from this material. Formerly London was the rubber center of the world; to that port the bulk of the world's production was shipped and there the prices of the commodity were fixed. The war has changed this.....

New York is at present the world's principal rubber market; prices are fixed here and the huge quantities of rubber coming through this and other American ports have established an industry in the United States which, in the current year, will consume rubber to the amount of over half a billion dollars.....

Factories specializing in rubber products of various kinds are now to be found in more than a score of different cities, but of these the most important is Akron, Ohio, which claims to be the premier rubber manufacturing center of the world. .....

The first rubber factory was established at Akron in 1869. The infant rubber industry occupied a building 40x100 feet in size and employed about 25 men. From this humble beginning this one concern has grown to be the largest rubber manufacturing organization in the world; its present plant occupying one hundred acres of floor space and giving employment to 18,000 persons. There are now 24 operating rubber companies at Akron, employing over 50,000 people, and manufacturing a daily average of 50,000 automobile tires and an equal number of tubes. ....

The Akron factories also manufacture immense quantities of rubber clothing, boots and shoes, hose, belting, surgical and druggists' goods and an almost unlimited variety of other articles in soft and hard rubber. It is stated that these companies make no less than 8,000 different and distinct rubber articles. [From *Dun's Review,* June, 1918.]

The Allied Economic Alliance

The statement which Lord Robert Cecil, the British Under Secretary of State for Foreign Affairs and Minister of Blockade, gave out on July 14th regarding the world's trade after the war is important chiefly for the simple mention of the fact that an association of twenty-four nations, bound together by a common opposition to the international policies of Germany, is already in existence and has been working along the most effective lines over a considerable period. This association of nations is a direct outgrowth of the alliance of eight nations entered into two years ago at the famous economic conference held in Paris. There is, however, this important difference to be noted: The earlier association of eight was a narrow defensive alliance, aimed quite as much against the abnormal impetus given by the war to the industries and commerce of the nations which were then neutral, including of course the United States, as it was directed against the rehabilitation of Germany. The present association, while still defensive in character, has for its main purpose such a combination of the resources of the nations which have entered into it as will make Germany impotent hereafter to use economic measures in preparation for future wars.

The present association of twenty-four nations is not bound together by any formal treaty or arrangement but the nations in it have been drawn together by material interests and a common purpose which make the union as strong as any formal alliance entered into around the council board. [*Weekly Export Bulletin.*]

The End of German Investments

The Alien Property Custodian stated recently in a hearing before a Senate committee that the amount of German-owned property in the United States would probably run to between $700,000,000 and $800,000,000. It is because of the hugeness of the total, as well as an appreciation of the naturally great influence of such an investment on the country's welfare, that the announcement made by the Custodian on July 16th of the formation of a selling organization to dispose of this property has been received with such general satisfaction. ....

A beginning has been made in an undertaking which will result in the elimiation of every trace of German interest and participation in the business of the United States. The enterprises sold will be operated as bona fide American concerns and in American interests exclusively, and the change will have an influence upon the economic future of the United States which can not at the present time be correctly gauged. [*Weekly Export Bulletin.*]

GEOGRAPHERS IN PRESSING DEMAND FOR WAR WORK

COMPETITION AMONG WAR BOARDS TO SECURE SERVICES OF WELL-TRAINED GEOGRAPHERS.

THE present war is developing a demand for Geographers to a remarkable degree. A majority of the geographers in the universities of the United States have been called upon to perform services for which they are peculiarly fitted. A few Geographers have been sent to France. Prof. D. W. Johnson, of Columbia University, has been in France for a considerable time, and Mr. Alfred Brooks of the United States Geological Survey, is a member of General Pershing's staff. Professor Lawrence Martin of the University of Wisconsin entered service almost as soon as we declared war and has been for several months attached to the General Staff, first with the rank of Captain and later with the rank of Major. He was sent to France for special work in August. Prof. W. M. Davis of Harvard has prepared a handbook of Northern France for the use of officers and others who need a topographical interpretation of the region adjacent to the Western Front. Prof. Gregory of Yale is a member of the National Research Council and is preparing courses in Geography for the universities where officers are being trained. Prof. Albert Brigham of Colgate has been asked to assist in the preparation of these courses. Prof. Robert DeC. Ward of Harvard and Prof. C. F. Brooks of Yale are in the Meteorological Service. Prof. Atwood of Harvard is giving valuable assistance in the training of officers at Harvard.

Some twenty or more Geographers have been called to Washington and are employed in the War Boards there. The War Trade Board has secured the largest number. The Bureau of Research of the War Trade Board has J. Russell Smith of the University of Pennsylvania, H. H. Barrows of the University of Chicago, R. H. Whitbeck of the University of Wisconsin, N. A. Bengtson of the University of Nebraska, C. J. Posey of the Uni-

versity of Minnesota, W. E. Hopper of the Michigan School of Mines, Herbert Bassett of the Macomb, Illinois, Normal School, Walter Lefferts and A. L. Pugh, graduates of the Wharton School of Commerce, University of Pennsylvania.

In the United States Shipping Board, Division of Planning & Statistics, are Prof. Walter S. Tower and Mr. C. C. Colby of the University of Chicago, Prof. V. C. Finch of the University of Wisconsin, Prof. George B. Roorbach of the University of Pennsylvania, and Prof. W. H. Haas of the Northwestern University. The War Department has Prof. Lawrence Martin of the University of Wisconsin, Prof. John R. Rich of the University of Illinois, Prof. Ellsworth Huntington of Yale, Prof. F. E. Williams of the University of Wisconsin, and Mr. Sumner Cushing of the Salem, Massachusetts, Normal School and Mr. M. K. Davis, formerly of the faculty of the University of Wisconsin.

If additional men of equally good training are available they will be needed in Washington, particularly in the War Trade Board, War Industries Board and Shipping Board, where men of broad knowledge of Economic Geography are especially valuable.

The war is demonstrating the need of well-trained geographers for Government service. If present indications may be trusted, there will be in the future an increasing demand for men of geographical training to act as consuls, trade agents, and in other similar capacities in foreign countries. The United States is sure to enter the markets of the world with increasing activity after the war, partly because of the great merchant marine which we shall have at our command when peace comes. We believe that universities throughout the country will do well to strengthen their departments of Geography.

EXPRESS COMPANIES IN THE UNITED STATES

THERE are eight Express Companies in the United States, namely: The Adams, American, Canadian, Great Northern, Northern, Southern, Wells-Fargo & Company, and Western. Eighty-five per cent of the express business is done by the American, the Wells-Fargo and the Adams. The other companies are comparatively small. The American Express Company does the largest volume of business (about thirty-five per cent of the total) followed by the Wells-Fargo which does about twenty-six per cent of the business, and the Adams which does about twenty-four per cent.

However, the Wells-Fargo covers the greatest mileage of transportation lines. Its service extends over 107,500 miles of transportation lines, including over one thousand miles of stage lines. Two thirds of the express business on steamboat lines is in the hands of the Wells-Fargo Company. The Great Northern Express Company serves almost exclusively the Great Northern Railroad Company. The Western and Northern Express companies cover respectively only 5,000 and 8,000 miles of transportation lines. The total operating income of the eight companies is upwards of a hundred million dollars annually. But there has been a serious reduction of express business due to the Parcel Post, and there has been in recent months a request on the part of the Express companies that they be taken over and operated by the Government, at least during the present war. There seems to be no reason why the Express companies and Parcel Post should not be combined in one service.

TRANSPORTATION ON THE MISSISSIPPI RIVER

BEFORE the Civil War the Mississippi River was one of our greatest commercial arteries. Steamboats passed up and down the great river in almost endless procession; but with the coming of the railroad about 1850, an increasing proportion of the western products found their way eastward by railroads, instead of southward by the Mississippi River. After the steamboats grew old and became unsafe they were abandoned and new ones were not built to replace them. One by one the steamship lines disappeared and only a very meager service continued down to recent years. At present the traffic carried on the Mississippi is merely a bagatelle in our internal commerce. Millions of dollars have been spent to improve the great waterway. Associations have been formed and books written and hundreds of bills introduced into Congress to spend more millions in the improvement of the Mississippi. The great promises that have been held out by waterway enthusiasts have always failed of realization. After each failure there have been renewed requests for more money, but when more money has been granted, continued failure has followed. In 1916 for example, less than two million tons of freight were carried in the section of the river between Memphis and Vicksburg and more than half of this was stone, sand and gravel. Excepting this group, nearly every commodity has notably declined in the last fifteen years; for example, the traffic in coal on the river in the stretch from Cairo to Memphis is only half what it was fifteen years ago, lum-

ber is one-eighth, and grain one-fifteenth. Only one million tons of all kinds of freight passed between St. Louis and Cairo in 1916, while eighty-seven million tons passed from Lake Suprior to Lake Huron through the Soo.

The time may come when it will be economical to spend hundreds of millions of dollars in the improvement of the Mississippi River, but there is no satisfactory evidence that that time is at hand. Fifty years of experience shows only disappointments and continued decline.

It is impossible to contrast the Rhine as a waterway with the Mississippi. The Rhine runs through a densely inhabited manufacturing and mining region. It runs in the direction that the heaviest traffic moves, and it is, on the whole, a river of relatively easy control. The Mississippi, on the other hand, flows though an agricultural region, most of which is thinly populated, and it flows in a direction in which a relatively small amount of traffic naturally flows. The Panama Canal may make some changes in this movement of traffic, but it will not greatly change present conditions.

THE PANAMA CANAL

IN 1917 it cost nearly seven million dollars to operate and maintain the Panama Canal. During the same year tolls yielded nearly six million dollars. There was, therefore, a deficit of only one million dollars, if interest on the cost of the Canal could be overlooked. If the interest rate is four per cent, the interest charge is about seventeen million dollars a year. During the fiscal year 1917, 1876 vessels passed through the Canal. Of these, 780 were British ships, 464 United States ships, 150 Norwegian ships, 99 Chilean, 86 Peruvian, 74 Dutch, and 72 Japanese. A very notable fact in this connection is the large increase in the number of Japanese and Peruvian vessels in the Panama Canal traffic. In 1915 only 6 Japanese vessels passed through the Canal, and 4 Peruvian vessels, while in 1917, 72 Japanese and 86 Peruvian made the passage. At the present time the traffic on the Canal is not being hindered by slides. Dredges are constantly at work and the channel is kept open. It is proved that the slides will continue to decrease as years go on and that eventually a position of equilibrium will be reached when the slides will cease. They are no longer a serious problem.

SOME CAUSES OF INDIA'S POVERTY*

INDIA contains nearly one-fifth of the human family, and much more than one-fifth of the family's poverty. Destitution is the normal condition of a great part of the population. The contents of a one-roomed house, the abode of the masses, would not in many cases be worth five dollars. While the average income in England is $210, in India it is only $10. Dadabhai Naoroji, an Indian member of the British Parliament, estimated the average income per capita at only $7. There is, however, a better distribution of wealth today than formerly.

In commerce India ranks first in Asia. In railway development she is the fifth country in the world, having 35,000 miles. The Government has given the country 15,000 miles of irrigation canals, bringing under cultivation 15,000,000 acres of land, making famine almost impossible in some districts. Concerning these great achievements the people say, "The British raj has done for us what even the gods failed to do."

In the civil government of the 315,000,000 people only 1,200 Europeans are employed. To all government offices below that of governor of a province the Indians are eligible, even to that of judge of the high court.

Until recent years the country has depended almost entirely upon agriculture. Though industrial enterprises are now multiplying and giving employment to many, the masses still live on the soil. Only 2 per cent of the population is found in cities of 100,000 or larger. In the United States the number living in large cities is ten times greater. India has 728,605 towns and villages. Farmers do not live on their fields but group together in villages.

With few exceptions modern methods of agriculture are not adopted. The masses still cultivate and harvest as the ancients did. For this reason great numbers of people are needed on the soil. Rice is all transplanted by hand in standing water. Sometimes it must be irrigated by drawing water from a well, where no irrigation canal is within reach. When ripe, the rice and all other crops are harvested with a sickle; the oxen tread out the grain and the wind is called into use to fan it. Five acres of land give a man enough work to keep him busy. He must hire laborers to transplant his rice, to weed his fields and cut his crop.

The rains are expected in June, after which farm work begins. One can imagine how eagerly the clouds are waited for, after months of scorching heat with the ground baked hard and

*By H. V. Andrews, in *Asia* for Dec. 1917, Vol XVII. pp. 812-814.

throwing off waves of heat long after sundown. The air by day is like an oven and at night is still stifling, so that a roof without a wall retains too much heat for sleeping purposes. The starry heavens are the only roof desirable at night in the hot season. An American engaged in an industrial mission, when asked about his work during the months of extreme heat, replied, "When evening comes and I find I have lived through the day I consider I have done a good day's work." The first rain is a great event, even the cattle showing signs of relief. When the rains fail or are insufficient, men's faces wear a serious anxious expression, in spite of the Hindu fatalism that is supposed to make calamity more acceptable.

India has to support 5,500,000 idle, holy men which the religions of the country impose as a burden on the people. Every village has its fund for feeding these mendicants, many of whom are constantly on the move. They are always sure of being fed, and well fed, for a day or two at any place they halt. Beyond the exertion necessary to reach the next village, they do absolutely nothing.

India is a land of famines. During the last fifty years twenty-two famines have carried off 28,000,000 people. The famine of 1900, the horrors of which I witnessed and was able to relieve in a small measure, brought death to 5,000,000 and left 50,000,000 destitute. With poverty the normal condition of the masses, the failure of one crop spells famine.

THE EARTH HAS HAD MANY ICE AGES

It is not strictly correct to speak of the "ice age" or the "glacial epoch," for there have been many of them. It is known that even the latest or Pleistocene glacial epoch had several important subdivisions, and it appears that in the Rocky Mountain region the time between the glacial subepochs was so long as to permit great changes in the form and height of the mountains, due to a wearing down by erosion.

More than 50 years ago English geologists recognized the fact that certain masses of gravel and breccia and certain planed and grooved rock surfaces in rocks of Permian age in India indicated a glacial epoch vastly older than that of the North American ice sheets, but only within the last 30 years have geologists learned that glacial conditions have recurred at many different times in the earth's history. The evidence of this fact has been found in all continents—in Europe, Asia, Africa, Australia, South America, and North America. Great ice sheets were formed at different periods in the larger divisions of geologic time back to the

Proterozoic—that is, to the age of the oldest known sedimentary rocks, a great many million years ago.

One of the most recent discoveries of old glacial deposits is that made by Prof. W. W. Atwood, of the United States Geological Survey, near Ridgway, in southwestern Colorado. Prof. Atwood there found typical glacial "till," containing pebbles and boulders showing well-preserved scratches and other markings, lying beneath Tertiary lavas of the San Juan Mountains and resting upon Upper Cretaceous beds. The conditions of the occurrence show that these gravels are of early Eocene age.

Professor Atwood's report of this discovery was issued by the United States Geological Survey, as part B of Professional Paper 95, under the title "Eocene glacial deposits in southwestern Colorado." A small stock of the report is still on hand, and copies may be had on application to the Director of the United States Geological Survey, Washington, D. C.

SALT PRODUCTION, 1917

Estimates of the production of salt in 1917 by States, in short tons, are as follows:

California	178,000
Kansas	726,000
Michigan	2,294,000
New York	2,175,000
Ohio	954,000
Texas	86,000
Utah	65,000
West Virginia	20,000
Hawaii, Idaho, Louisiana, Nevada, New Mexico, Oklahoma, Porto Rico, and Virginia	447,300
	6,946,000

UNCLE SAM AS A LAND HOLDER

DESPITE Uncle Sam's continuous generosity in giving away land to almost anyone who would take it, he still has in the United States proper 230,000,000 acres of unappropriated and unreserved land, and in Alaska more than 300,000,000 acres. The 230,000,000 acres in the United States proper are mainly in ten western states. Nevada alone has 55 million acres of "public land." Ohio's total area, for example, is less than half this amount.

OUR SINGLE ANTHRACITE COAL AREA

ASIDE from a very small quantity of hard coal in Colorado and New Mexico, all of our anthracite is located in a small area of 480 square miles in eastern Pennsylvania. The small area however contained more than 20 billion tons of coal when mining operations began, and still contains more than 16 billion tons. And yet this enormous amount of coal is a small fraction of what was originally deposited there. Long ages of denudation have eroded and carried away far more coal than is left.

THE JOURNAL OF GEOGRAPHY TO BE TAKEN OVER BY THE AMERICAN GEOGRAPHICAL SOCIETY JANUARY 1, 1919.

SINCE the establishment of the *Journal of Geography*—originally known as the *Journal of School Geography*—over twenty years ago, the magazine has been under personal management and control. During the first thirteen years Professor R. E. Dodge of the Teachers College, New York, carried most of the responsibility on his own shoulders. During the last eight years the present editor has carried the major part of that responsibility. At no time has there been any effort to make money from the magazine.

During the past summer, the American Geographical Society of New York offered to take over the complete ownership and control of the Journal and the offer was promptly accepted. The broad-guage men who dominate the American Geographical Society, the generous and enlightened policies which mark all its plans, the resources of every sort at its command, and the genuine interest which it takes in educational geography, all unite in an assurance that the *Journal of Geography* will soon enter upon the most promising period of its history. The American Geographical Society can give a stability and strength to the magazine which personal control can never give. During the remaining four months of 1918, the present editorial and business management will continue.